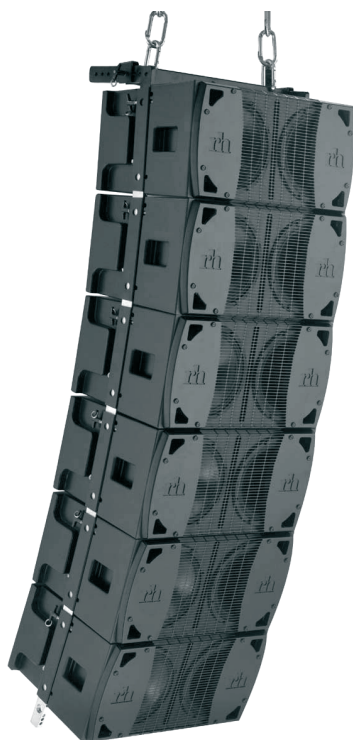
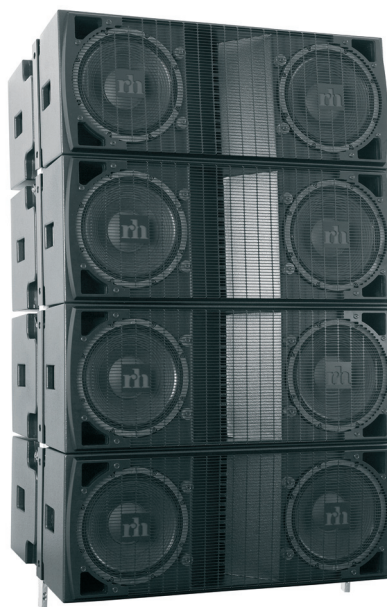


Line Arrays

User's Manual



PN102/LA & PNX102/LA



STLA/9 & STXLA/9

TECHNICAL SUPPORT

**If you have a question about line
arrays or run into a problem
using one of our line arrays,
call our technical support staff.**

Phone: 949 588 9997

Monday through Friday between 8:00 AM and 5:00 PM Pacific Time.

Ask for:

Jim Mobley (Extension 104)

Jonas Domkus (Extension 135)

E-mail

Jim@renkus-heinz.com

Jonas@renkus-heinz.com

PLEASE take a little time to learn how to get great results with your Renkus-Heinz Line Array System. It's a small investment that will generate a large payoff: more satisfied clients, more efficient operations and better recognition for your skill as a sound reinforcement professional.

INTRODUCTION

Renkus-Heinz Engineering has developed unique approaches to the line array

The Isophasic Plane Wave Generator lens shapes high frequency response so that vertical arrays produce a continuous, coherent wavefront whose curvature can be shaped to the audience area by curving the array.

The Midrange Diffraction Baffle used in the PN102/LA and PNX102/LA modules moves the woofers' acoustic centers closer together in the horizontal plane to eliminate "coverage collapse" in the crossover region.

The CDT1.5 CoEntrant Driver used in the STLA/9 and STXLA/9 integrates 6.5 inch carbon fiber cone and 2.5 inch voice coil titanium compression drivers into a high output wideband point source.

Line Arrays are not hard to use when you understand how they work...

The R&D behind our Line Array Systems is grounded in years of practical experience with the problems of delivering reference reproduction for large audiences at professional SPLs. Our engineered solutions include a simple yet highly accurate software design tool – **AimWare**. The flying hardware is keyed to the design software and will easily enable you to fly your array at the height and angle determined using **AimWare**, and with the proper curvature. Self-powered line array modules include all the system optimization and protection functions needed to ensure peak performance. Externally-powered modules use RH-Engineered controllers to provide the same high performance with centralized power amplifier racks.

... but curved vertical arrays require different design techniques...

For the past 20 years, sound reinforcement professionals have worked with horizontal arrays that use megaphone-variant horns to deliver "[more or less] equal power to equal **angles**." Vertical arrays (so-called "line arrays") are designed to deliver "[more or less] equal power to equal **areas**." This is the key to consistent SPL and frequency response from the front to the rear of the audience area.

... and unfamiliar operational practices.

Over the years, system designers and operators have developed a number of signal processing techniques to disguise and partly overcome the limitations of "constant directivity" horns: for more information on these techniques and their limitations, see our White Papers on the True Array Principle and Reference Point Array design. "Frequency shading," "amplitude shading," "system tuning," all of these are tools of the advanced sound system operator.

WHILE THESE TECHNIQUES ARE APPLICABLE TO LINE ARRAYS, THEY OFFER LIMITED IMPROVEMENT TO THE LINE ARRAYS PERFORMANCE. Instead of enhancing the array's performance they could severely degrade it. This is because line array performance depends on all array modules receiving the same signal at the same level, in order to produce a continuous, coherent wavefront. Coverage control is achieved by mainly by tilting and curving the array relative to its hang height. Subtle amplitude shading of the bottom most loudspeakers can improve front to back coverage consistency, but it needs to be used with care.

For more information on line array design practices, refer to pages 10 to 12 of this manual.

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Thank you for selecting a Renkus-Heinz Line Array System. This manual is intended to help you obtain optimum performance from your system. Your system is one of the four types described below and on the next page.

PN/PNX SYSTEMS



PN102/LA & PNX102/LA

PN102/LA SYSTEMS

PN102/LA Self-Powered Line Array Module. 2x 10" LF drivers with Midrange Acoustic Diffraction Baffles and two 1" exit HF drivers on an Isophasic Plane Wave Generator. Engineered for use in vertical arrays; integral two-point flying hardware. Self-powered with the PN-1 PowerNet amplifier: R-Control optional.

PNX102/LA SYSTEMS

PNX102/LA Line Array Module. Designed for bi-amp power with external amplifiers using X-Series analog or D26 digital controllers for Loudspeaker Specific Processing and protection. Uses the same components and pattern control technologies as the self-powered PN102/LA module.

The PNX102LA uses 16 Ohm LF and 16 Ohm HF driver configurations. This enables a single amplifier to drive a number of array modules.

ALL PN102/LA & PNX102/LA SYSTEMS



RHANG/LA Fly Bar. Coupled with the two-point angle-setting system on Renkus-Heinz Line Array modules, it provides a safe, flexible and simple means of flying vertical arrays up to 12' deep.

RHANG/LA Tie Bars and Quick-Disconnect pins provide a choice of splay angles and metal-to-metal reliability.

102Dolly holds up to 4 PN102/LA or PNX102/LA modules.

STLA/STXLA SYSTEMS



STLA Line Array Systems

STLA/9 Self-Powered Line Array Module. 136 dB peak output, yet under 200 lbs. 2x 12" LF drivers and two CDT1.5 CoEntrant Drivers on an Isophasic Plane Wave Generator. Engineered for use in vertical arrays; integral two-point flying hardware. Self-powered with the PM-3 PowerNet Tri-Amplifier: R-Control optional and CobraNet inputs optional.

Subwoofer: DR18-2 self-powered dual 18" subwoofer recommended.

STXLA Line Array Systems

STXLA/9 Line Array Module. Designed for tri-amp power with external amplifiers using the X14 Controller for Loudspeaker Specific Processing. Uses the same components and pattern control technologies as the self-powered STLA/9 module.

Subwoofer: DRS18-2 externally-powered dual 18" subwoofer recommended.

All STLA Systems



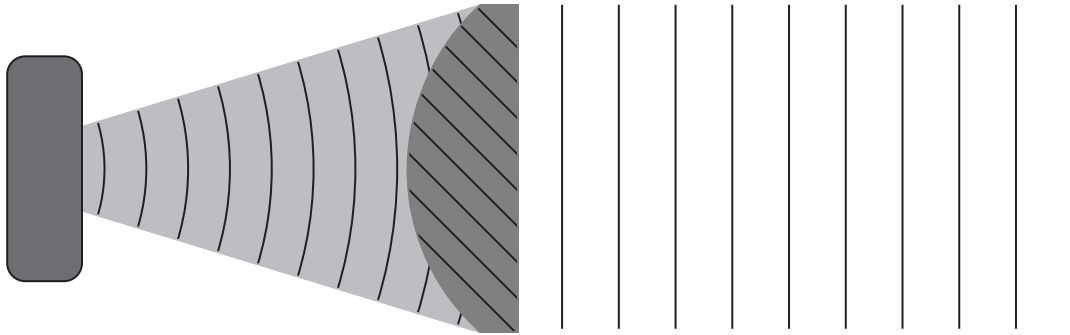
RHANGSTLA Fly Bar. Coupled with the two-point angle-setting system on Renkus-Heinz Line Array modules, it provides a safe, flexible and simple means of flying vertical arrays up to 12' deep.

RHANGSTLA Tie Bars and Quick-Disconnect pins provide a choice of splay angles and metal-to-metal reliability.

STDolly holds up to 4 STLA/9 or STXLA/9 modules

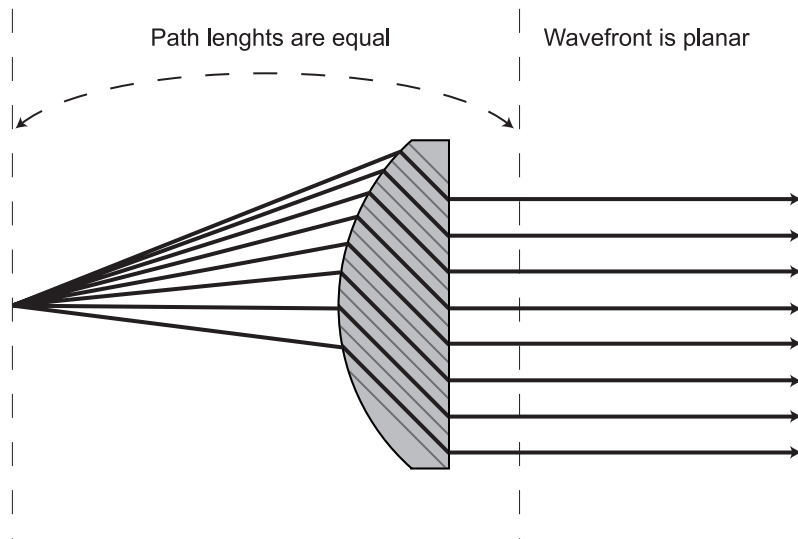
ALL LA SYSTEMS

RH Engineering has developed an acoustic lens of the “path length refractor” type in order to change the output of a horn/driver into a planar wavefront. A schematic of the HF section of a Renkus-Heinz Line Array Module looks like this:

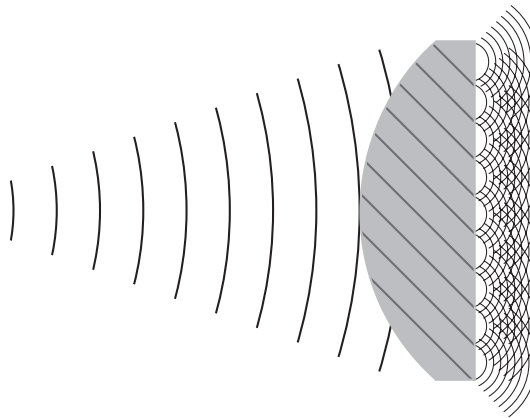


Renkus-Heinz line array modules use pattern control techniques that have been borrowed from microwave research. Since microwaves have characteristics similar to high frequency sound waves, these techniques are useful for creating continuous HF wavefronts. The Path Length Equalization Technology used in this device has a significant advantage over other techniques (such as reflectors and obstacle arrays). Reflectors and obstacle arrays operate over a relatively narrow bandwidth: perhaps four octaves. This limitation is due to the transition from the “ray model” (reflection) to the “wave model” (refraction and diffraction) that occurs as wavelengths become long in relation to the reflector or the obstacles.

The path length refractor, however, can generate planar wavefronts over a wide operating band. When higher frequencies pass through the device, it operates on the “ray model,” as illustrated below:



When the “wave model” takes over due to the longer wavelengths, the path length refractor lens functions as a closely spaced array of diffraction slots, as illustrated on the next page.



Slots are $< 1/2 \lambda$ apart: wavefront is planar

THE STLA'S COENTRANT DRIVER

The patented CoEntrant Driver integrates the output of a cone transducer and a compression driver into a single high output, wideband point source. Coupling these devices with Complex Conic horns has generated a number of highly effective horizontal array modules – the ST Series of products.

The new CDT 1.5 CoEntrant driver has been developed for use in high output line array modules. It integrates a 6.5 inch carbon fiber cone transducer with a 2.5 inch voice coil compression driver. The CDT1.5 can be crossed over as low as 350 Hz, allowing a properly designed waveguide to control dispersion over a frequency range of almost six octaves.

CDT (COENTRANT DRIVER TECHNOLOGY) & PWGT: (PLANE WAVE GENERATOR TECHNOLOGY): AN IDEAL COMBINATION

Because of its ability to function as a diffraction slot array at lower frequencies and as a path length refractor at higher frequencies, the Plane Wave Generator is able to control vertical dispersion over the entire operating bandwidth of the CDT1.5. A vertical array of these devices will produce a coherent wavefront from 350 Hz to 19 kHz. The sound system design can shape the vertical dispersion of this wavefront by altering the splay angle between modules. This is the key to adapting the line array's output to a particular venue in order to deliver consistent SPL from front to rear.

For more information on Path Length Equalization Technology and the Plane Wave Generator, please refer to the Renkus-Heinz White Paper on "New Approaches to Line Array Module Design."

Renkus-Heinz **AimWare**. Windows software simplifies the design and implementation of PN/PNX and ST/STX line arrays. Please consult the Renkus-Heinz web site (rh.com or renkus-heinz.com) to download the latest software releases.

Tie Bars and Quick-Release Pins are included with each Renkus-Heinz Line Array module. They provide simple selection of inter-module splay angles within a metal-to-metal load bearing system that is independent of the enclosure structure.

Please devote your time and attention to reading this manual. A comprehensive understanding of line array theory, curved vertical arrays and specific features of your Renkus-Heinz Line Array System will help you to operate these products safely and obtain optimal performance.

Line source coupling only occurs at longer wavelengths/lower frequencies

This is because adjacent sources have to be less than 1/2 wavelength apart in order to couple coherently. Audible frequencies have a wide range of wavelengths, from over 50 feet at 20 Hz to about 1/2 inch at 20 kHz. Obviously it's easy to get two sources to couple coherently at 20 Hz, because the wavelength is about 50 feet. Since high output compression drivers have voice coils between 2 and 4 inches in diameter, it is almost impossible to produce line source coupling at 10 kHz, where the wavelength is about 1 inch.

The longer the line, the lower the frequencies it will control and the tighter the beam

A theoretical point source, with perfectly spherical radiation, can be considered as a line with no height. For any line of finite dimensions, the transition from line source radiation (flat or plane wave with -3 dB energy loss per doubling of distance) to point source radiation (spherical wave with -6 dB per distance doubling) begins at the frequency whose wavelength is twice the height of the line, and is complete one octave lower at the frequency whose wavelength is four times the line's height. For example, a 12 deep array of STLA/9 modules will be 15.5 feet tall and will radiate as a line source above 35 Hz.

High frequencies are always radiated from separate sources and waveguides

Applying the line source calculations summarized above, it becomes clear that 2.5 voice coil compression drivers cannot couple as a line source above 2650 Hz (6.5 inch midrange cones radiate as separate sources above 1025 Hz). Yet the compression driver must operate up to 18 or 19 kHz. Clearly, some sort of waveguide technique that allows adjacent array modules to produce a coherent and continuous wavefront is required.

Christian Heil was the first to demonstrate that such a waveguide was possible. Since then a number of other approaches have been used successfully. Interestingly enough, all of these have been used for decades to control microwave radiation, which happens to have many of the same characteristics as high frequency sound. Renkus-Heinz has employed the acoustic lens technique in its Isophasic Wave Generator. One advantage of an acoustic lens is that the technique is equally successful with a wave model (i.e. at lower octaves) and with a ray model (higher octaves). Therefore the lens technique is effective at controlling a broader range of frequencies than reflection-based designs which are only operative on rays (very high frequencies). Another advantage of the acoustic lens is that the wavefront curvature is independent of the path length from the driver to the waveguide exit.

Vertical arrays take one of three possible shapes: flat (line, straight or "I" arrays, symmetrically curved or "J" arrays and asymmetrically curved or "J" arrays.

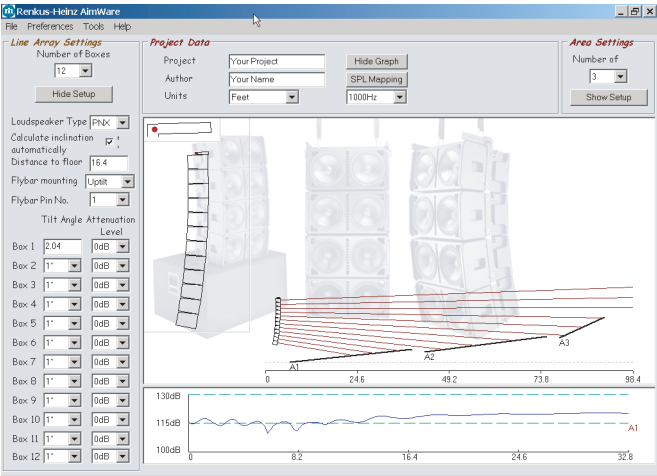
The flat shape is a pure line source, at least at low frequencies. Curving the line array broadens the dispersion. Curving the bottom of the line array only widens dispersion in the lower section (coincidentally this is the section that is closest to the audience). It also tilts the main beam of the array downward.

Variants of the "J" produce the best results in the vast majority of applications

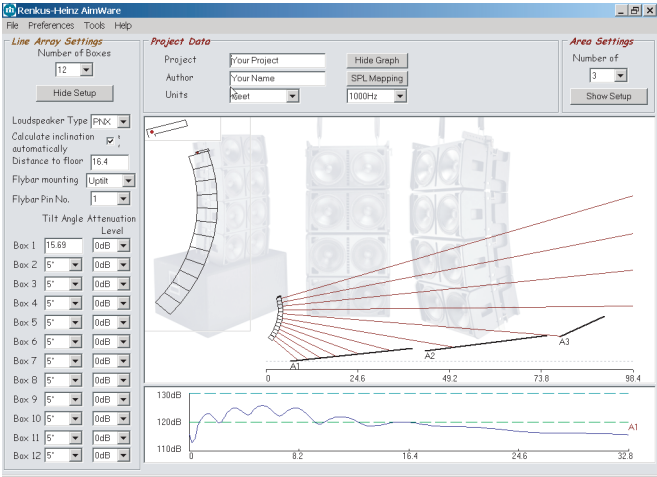
By "best" we mean the "most consistent amplitude and frequency response from the front to the rear of the audience."

As a point of reference, horizontal arrays are pie sections of a spherical source: their energy is reduced by 6 dB with each doubling of distance. In the typical large venue with a distance ratio of 4:1 from the closest to the farthest seats, this means that the front rows are 12 dB louder than the back. Look closely at the Aimware screens shown on the following pages. They illustrate how the three vertical array shapes behave in this type of venue.

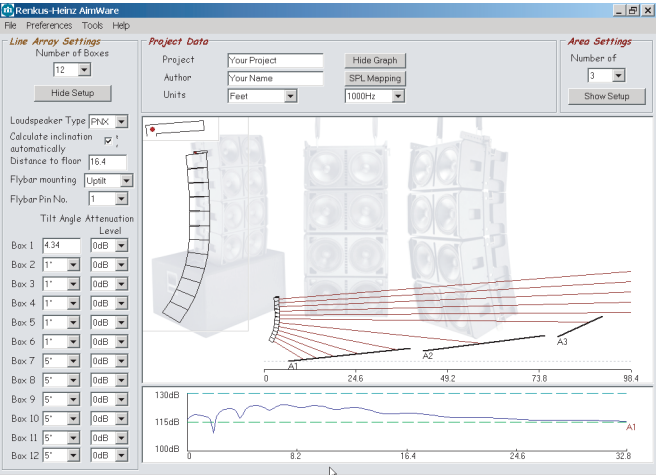
Straight (flat) Line Array



Curved Line Array



“J” Line Array



AimWare provides a visual interface to the complex math behind vertical array optimization

If you happen to own a “line array” system and have a week or two in an empty venue to prepare for your next event, feel free to set up multiple measurement systems at, for example, a dozen points in the audience area. Then experiment with different hang points, aiming angles, number of modules and splay angles. The possibilities are almost endless and a large number of data points are required before reliable correlations between various design factors and the actual results begin to appear.

Alternatively, you can download **AimWare**, the Renkus-Heinz Windows based software program for the design and optimization of vertical arrays. **AimWare** lets you define audience areas that closely model the real world of performance venues. It then allows you experiment with different array configurations (hang points, trim height, tilt angle, number of modules and splay angles). Best of all, AimWare shows you accurate predictions of real world results in seconds, not hours.

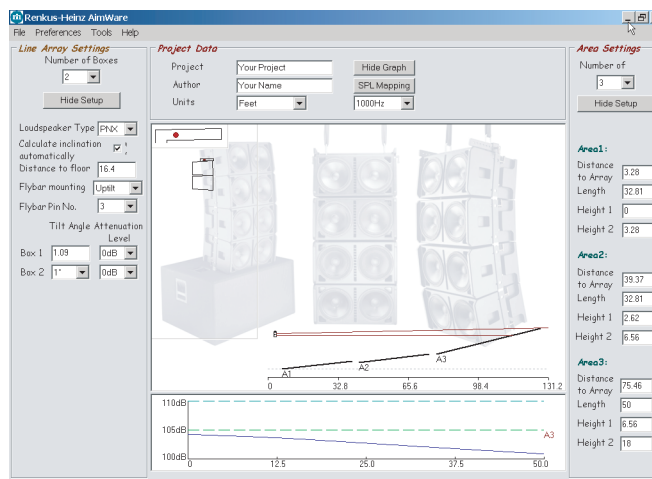
When you are done you can save the design as a file for later recall or modification. You can also import the file into EASE 4.1 or EASE JR 4.1 for further evaluation in EASE.

Line arrays are not “point and shoot” systems

A little experimentation in **AimWare** will confirm that it is not good design practice to simply aim a flat “line source” vertical array at the center of the audience area. The typical result would be a few very loud rows in the middle of the seating area with insufficient level at the front and rear. Nor is it possible to get good results by aiming the top module in the array at the back row of the audience and the bottom row at the front row. The height, tilt angle and curvature of the array all interact to produce the desired effect (consistent SPL front to rear). The optimum angles are often non-intuitive (there is no simple “formula” that says “hang X boxes at 0° vertical splay, then X more at medium splay and X at the bottom with maximum splay.”

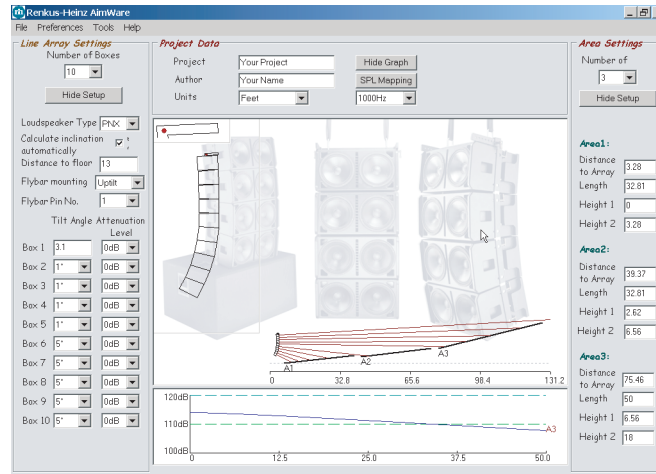
Designing a Vertical Array with Aim Ware

Define the Venue



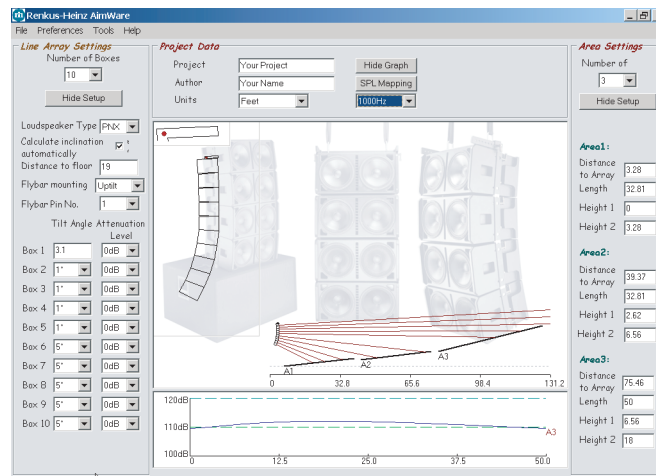
Define the depth and location of up to three audience areas with independent start and end points.

Locate the Array



In most venues your choice of location will be extremely limited.

Optimize the Array



Your goal is to make the frequency response curve as flat as possible while delivering the desired SPL. Use the boxes at the left of the screen to add or remove modules and to set the splay angles. AimWare shows you instantly whether you are getting closer to an optimum design or farther away. For most venues, the entire design process will take less than one hour.

Save Your Configuration

The final step is to save the design as a file for later recall or modification. You can also import the file into EASE 4.1 or EASE JR 4.1 for further evaluation in EASE.

SYSTEM SETUP: ELECTRONICS

STLA Self-Powered Systems

STLA line array modules are self-powered with the PM-3 PowerNet Tri-Amplifier. The Class D amplifier section and the Loudspeaker Specific Processing electronics require appropriate AC power. Audio inputs can be either high-CMRR analog audio inputs with XLR looping connectors or CobraNet digital audio inputs. If a R-Control remote control and supervision network is installed, its connections can be made via a separate twisted pair cable and Phoenix connector or in systems having CobraNet, with the CobraNet connectors.

Source Signal

Source signal connections to a self-powered STLA array are quite straightforward. Connecting analog signal simply requires one cable from the top module to the snake. Subsequent modules can then be connected using the PM-3's looping XLR inputs and outputs. Of course, if you intend to use level shading as part of your array design, you will need to attenuate the inputs to all modules that receive different signal levels.

STXLA Externally-Powered Systems

STX Amplifier Selection

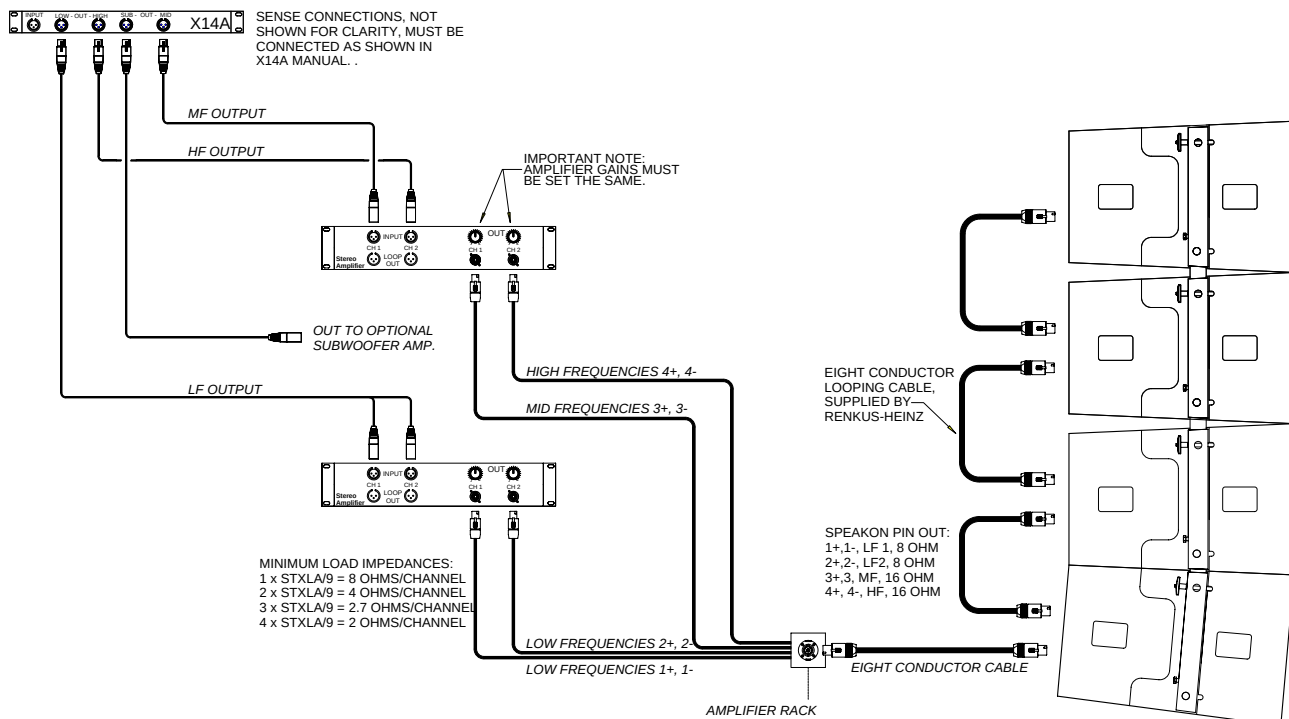
STXLA array modules are tri-amplified. For optimum performance we recommend the X14 Controller and the following power amplifier ratings:

LF 1,000 to 2,000 watts, RMS @ 4 ohms

MF 400 to 800 watts, RMS @ 4 ohms

HF 160 to 320 watts, RMS @ 4 ohms

All amplifiers must have the same voltage gain.



PN/LA Self-Powered Systems

PN/LA modules are self-powered with the PN-1 PowerNet Amplifier. The Class A/B amplifier section and the Loudspeaker Specific Processing electronics require appropriate AC power. Audio inputs are high-CMRR analog audio inputs with XLR looping connectors. If the R-Control remote supervision network is installed, connections can be made via a separate twisted pair cable and Phoenix connector.

Source Signal

Source signal connections to a PN/LA array are quite straightforward, unless you intend to use level shading as part of your array design. Connecting analog signal simply requires one cable from the top module to the snake. Subsequent modules can be connected using the PN-1's looping XLR inputs and outputs. Of course, if you intend to use level shading as part of your array design, you will need to attenuate the inputs to all modules that receive different signal levels.

Optional CobraNet Connections

The optional Renkus-Heinz CobraNet Breakout Box provides a very simple way to add CobraNet connectivity to the system. Each Breakout Box can supply signal for up to six modules.

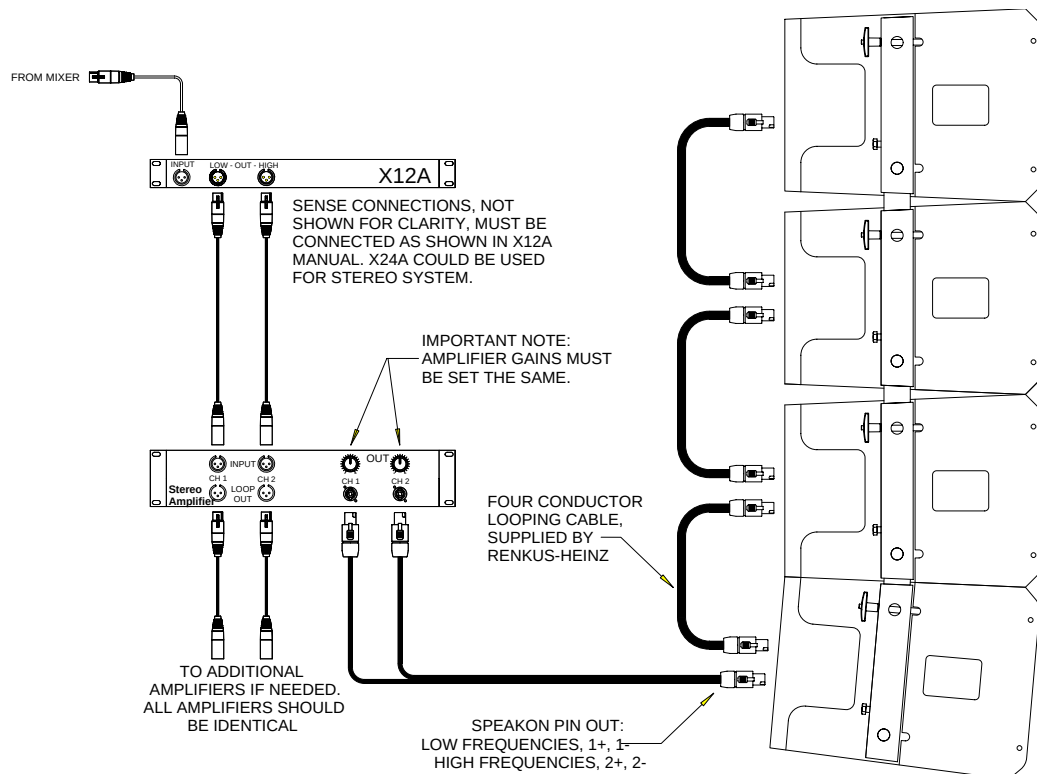
PNX/LA Externally-Powered Systems

PNX Amplifier Selection

PNX/LA array modules are bi-amplified. For optimum performance we recommend the X12 Controller and the following power amplifier ratings:

LF 400 to 800 watts, RMS @ 16 Ohms

HF 80 to 160 watts RMS @ 16 Ohms



Rigging Procedures

The designs of the RHANG/LA and RHANGSTLA rigging systems have been optimized for the mechanical and acoustical characteristics of Renkus-Heinz line array modules. RHANG flying hardware enables a variety of system configurations to be flown with a minimum number of motor hoists. Vertical angle adjustment between cabinets has been limited to specific settings to ensure proper acoustic coupling.

Before flying any Renkus-Heinz line array, please ensure that all necessary components are present and undamaged.

The RHANG system is a professional precision tool and should be handled with extreme care. Only persons who are fully conversant with the operation of the RHANG flying hardware and provided with suitable safety equipment should install and operate the system. Misuse of the RHANG hardware system could lead to injury. Please refer to the Safety section below for advice concerning installation and handling.

Maximum efficiency will be realized when three experienced persons participate in the set-up: typically one motor hoist operator, and one PN/LA or STLA operator per side of the array. Good synchronization and crosscheck between the operators are the keys to reliability and safety.

Used and maintained correctly, RHANG flying hardware will give many years of reliable service in portable systems. This requires frequent, regular and thorough inspection, maintenance and cleaning of the system. Please refer to the appendix for further information.

SAFETY FIRST

This manual offers guidance only for Renkus-Heinz loudspeaker systems. References in this manual to other rigging equipment, such as motor hoists, steels, shackles etc., are made to clarify the description of rigging procedures. The user must ensure that operators are properly trained by other agencies in the use of these items.

The following points are designed to remind the user of safe practice when flying any loudspeaker system. They cannot address every possible circumstance in which the system might be deployed; therefore the user must always apply his or her knowledge, experience and common sense. If in any doubt, seek assistance from qualified rigging personnel.

Flying Loudspeakers Safely

Always inspect all the rigging components and cabinets for damage before assembly. Pay special attention to the lifting points and safety clips. If you suspect that any of the components are damaged or defective, DO NOT USE THE AFFECTED PARTS. Contact your supplier for replacements.

Ensure that all local and National regulations regarding the safety and operation of flying equipment are understood and adhered to. Information on these regulations can usually be obtained from Local Government Offices.

When flying a loudspeaker system always wear protective headwear, footwear and eye protection.

Do not allow inexperienced persons to handle the loudspeaker system. Installation personnel should be trained in loudspeaker flying techniques and should be fully conversant with this manual.

Ensure that motor hoists, hoist control systems and ancillary rigging components are currently certified as safe and that they pass a visual inspection prior to use.

Ensure that public and personnel are not allowed to pass beneath the system during the installation process. The work area should be isolated from public access.

Never leave the system unattended during the installation process.

Do not place any object, no matter how small or light, on top of the system during the installation procedure. The object may fall when the system is flown and is likely to cause injury.

Secondary safety steels must be installed once the system has been flown to the operating height. Secondary steels must be fitted irrespective of requirements of the local safety standards applicable to the territory.

Do not fly the system over areas to which the audience has access.

Ensure that the system is secure and prevented from pivoting about the motor hoist. Avoid any form of dynamic loading to the assembly.

NEVER attach any item to the RHANG hardware other than the RHANG accessories.

When flying outdoor systems ensure that the system is not exposed to wind or snow loads and is protected from rainfall.

The RHANG flying hardware requires regular inspection. We recommend that the system be inspected visually at every opportunity. For more information on visual inspection procedures and common problems with rigging components, download the Rigging Inspection Poster from ATM Flyware (<http://www.atmflyware.com/flyhome.html>).

When de-rigging the system ensure that the same care is given to the procedure as for the installation. Pack RHANG components carefully to prevent damage during transit.

Ground Stacking Loudspeakers Safely

Statistically, many more injuries occur due to unstable ground stacked PA systems than to improperly flown systems. There are several reasons for this fact, however the message is clear.

Always survey the supporting structure upon which a ground stack is to be built. Always look beneath PA wings to inspect the deck support and if necessary ask for the stage scrims and dressings be removed to allow access.

If the stage surface slopes, as it does in some theatres, ensure that the system is prevented from sliding forward due to vibration. This may require attaching wood battens to the stage floor.

For outdoor systems, ensure that the system is protected from wind forces which might cause the ground stack to become unstable. Wind forces can be huge, especially upon large systems and should never be underestimated. Observe meteorological forecasts, calculate the "worst case" effect upon the system prior to erection and ensure that the system is secured appropriately.

Take care when stacking cabinets. Always employ safe lifting procedures and never attempt to build stacks without sufficient personnel and equipment.

Never allow anyone, whether operators, artists or members of the public, to climb onto a ground stacked PA system. Anyone who needs to climb over 6 feet high should be fitted with suitable safety equipment including a clip-on harness. Please refer to local Health and Safety legislation in your territory. Your Renkus-Heinz distributor can help with advice on access to this information.

Apply the same attention to all safety matters when de-stacking systems.

Be aware that safety procedures are as important in the truck and in the warehouse as they are at the venue.

Training & Education

Correct training is fundamental to safe practice when working with loudspeaker flying systems. We recommend that users contact local industry associations for information on appropriate courses.

SETUP PROCEDURES



- STLA line array modules can be stacked up to four high on the STDolly



Splay angles can be set while the cabinets are on the ground. To set minimum splay angle, simply insert the quick-release pin through the receiving tube and into the tie bar.



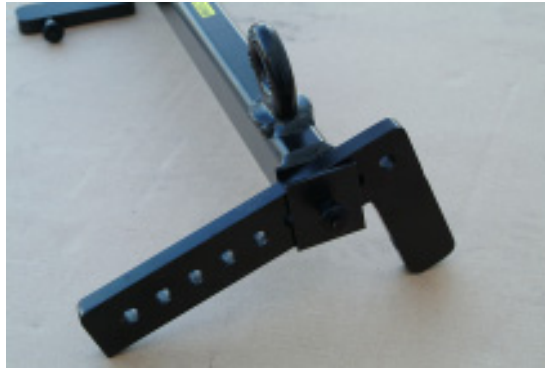
Splay angles can be set while the cabinets are on the ground. To set minimum splay angle, simply insert the quick-release pin through the receiving tube and into the tie bar.



To set medium or maximum splay angle, two operators (one per side of the enclosure) should lift the top enclosure until the proper holes on the tie bar and receiving pin are aligned. Then insert the quick-release pin. Check to make sure that both sides of the enclosure are set to the same play angle.



The RHANGSTLA fly bar will support arrays up to 12 deep. It provides a simple way to alter the array's tilt angle without requiring multiple rigging points and motors.



Before attaching the flybar to the top array module, attach the side pieces using the provided quick-release pins.



RHANGSTLA hardware is manufactured for Renkus-Heinz by ATM Flyware.



To attach the RHANGSTLA fly bar, insert it into the receiving tube and then insert the quick-release pin.

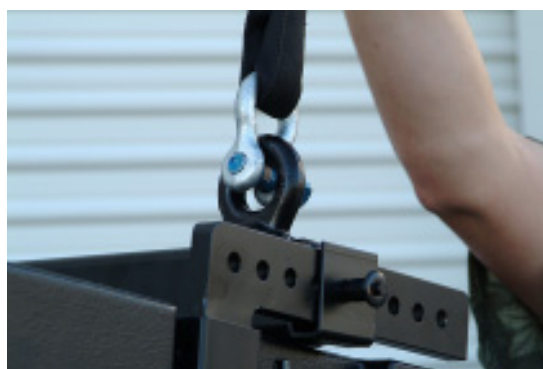


The tilt angle of the entire array is set by moving the bridle attachment bar forward or backward. When moving the bridle attachment points, check that the attachment knobs are completely locked. Also check that both sides of the top bar are located to the same hole on the angle-setting bar.



-

Attach the rigging to the bridle attachment point.



Start lifting the array



Inspect the shackles



Self-powered modules require a signal connection (analog XLR or digital CobraNet). Connect the top module of each group that will receive the same signal first.



All modules in the group that will receive this signal can be connected using the Looping XLR connectors. Note: if you are not using level shading, the “group is the entire array.



- Once AC power is connected you will be able to check the status of the module's LF, midrange and HF sections using the Mute buttons and LED indicators on the PM-3 Digital Tri-Amplifier.



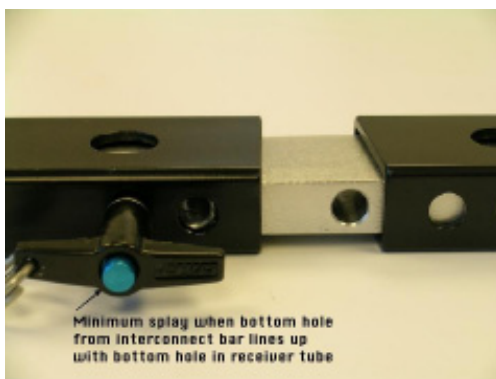
Renkus-Heinz uses the Neutrik PowerCon connector for self-powered loudspeaker systems. Each module requires its own AC cable and connector. Make sure the connector is locked into the socket.



- To power the module on, use the Power switch next to the connector.



The RHANGSTLA Tie Bar has 3 angle setting positions



To set adjacent modules at 0° splay, align the bottom hole on the Tie Bar with the bottom hole in the lower module's receiving tube.



For medium splay (3° in “uptilt” position or 2° in the “downtilt” position) align the top hole in the Tie Bar with the top hole in the receiving tube.

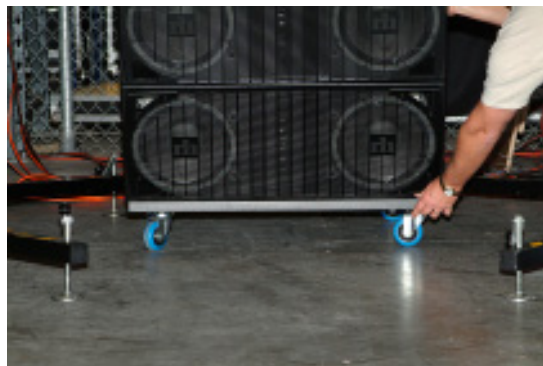


For maximum splay (i.e. 5° in “uptilt” position or 4° in “downtilt” position) align the middle hole on the Tie Bar with the bottom hole on the receiving tube.

LANDING THE SYSTEM AND LOADING OUT



Carefully lower the array onto the dolly.



Align the front edge of the dolly (the one without a supporting ledge) and the front edge of the lowest module.



The module's tie bars fit into slots on the sides of the dolly.



Attach the module to the dolly using quick release pins on both sides.



- The STDolly will support up to four modules. Remove the quick release pins from both sides of the fourth

module from the bottom.



Have one operator stabilize the dolly-stacked modules, then raise the array until the tie bars are free of the receiving tubes.



Roll the dolly and the stack of modules out of the way and repeat the process until the entire array has been stacked on dollies.



Remove the shackles from the RHANGSLTA fly bar



Detach the fly bar from the top array module. Make sure that all parts are properly stowed for transport.

TROUBLESHOOTING & SYSTEM CHECK LIST

X12, X24 and X14 Controllers

Are the sense lines properly connected to the amplifiers? Are the correct Loudspeaker Specific Processing modules installed?

D26 Digital Controller

Is the proper loudspeaker-specific configuration selected on your D26?

External Amplifiers

Are all power amplifiers used with X-type externally powered line array modules and subwoofers properly configured? In particular, check voltage gain settings and input gain settings.

Signal path – for self-powered systems

Are all line array modules properly connected? Are the subwoofers connected with the same polarity as the main arrays? If the subs and the main arrays are driven by separate sends from the main console, are those outputs in phase?

Loudspeaker wiring

Are all line array modules receiving the same signal? For externally powered modules, are all three sections functioning? Are they in proper polarity? Do the subs have the same polarity as the main array? Are all the subs wired with the same polarity (if you turn one section off does the level decrease (proper polarity), increase (trouble!) or stay the same (also trouble!))?

Vertical Array Configuration

Are the splay angles the same on both sides of each module? Are the splay angles set as per the design generated by Aimware? Are the aiming angles the same for both left and right arrays?

Final Pre-Sound-Check Check

Play a CD and send a mono-summed signal first to the left array, then to the right. Both sides should sound the same when listening from a position along the center line between both arrays. Now play both sides at once, in mono: all frequency bands should appear to originate from a “phantom center” source located on the center line between the two arrays. If this is not the case, you must lower both arrays and repeat the previous steps to locate the source of the problem.

INSTALLATION TOOLS AND SYSTEM MAINTENANCE

Recommended installation tools and equipment

Many of the tools listed below are not actually required if you used **AimWare** to design your line array. However, they are useful to verify that the array's location and aiming conforms to the **AimWare** design criteria.

Tape measure – should be 30m/100ft in length and be of durable fiber material. Have one per array available to speed up the installation process.

Laser inclinometer – For measuring vertical and horizontal angles in the venue. An ideal product is the Calpac 'Laser projecting a dot' version.

Carpenter's level – used to ascertain the trueness of the surface from which the angle measurements originate.

Rangefinder measuring device – either a Disto type laser measure or an optical laser rangefinder can be used. Sports rangefinders, such as the Bushnell “Yardage Pro”, provide sufficient accuracy, are easy to use, and work outdoors in bright sunlight.

Electronic calculator with trigonometric functions to calculate the height from ground level to points in the room. The formula to calculate height of a point from measured angle and distance is:

Height of point = $\sin(\text{vertical angle in degrees}) \times \text{distance to point}$ NB: Take care when using Excel or other spreadsheets, which typically default to a calculation using radians. To convert degrees to radians use the formula: Angle (in radians) = $3.142 \times \text{Angle (in degrees)} / 180$. The factor 3.142 is, of course, an approximation of π (pi).

Computer – Laptop or Desktop PC running Windows 95/98/2000 or XP with the current version of Renkus-Heinz **AimWare** installed. It is not possible to configure a Renkus-Heinz Line Array properly without using **AimWare**. Designs can, of course, be prepared prior to arrival at the venue, but it is often necessary to modify or update the design to accommodate special circumstances. A PC is absolutely essential to make such changes.

Digital remote inclinometer – with a remote sensor in the bumper and a meter unit at ground level to ensure precise aiming of the cluster. A typical unit for this purpose is the Schaevitz Anglestar.

Audio Analysis Software – strongly recommended but perhaps not absolutely essential. SDA EASERA, or SIA SmaartLive, SmaartPro or Spectrafoo enable rapid and detailed analysis of the acoustical performance. EASERA and SmaartLive offer the additional benefit of enabling you to adjust FOH EQ on the D26 Digital Controller while observing the results in a dual-FFT window on your laptop. Consider taking a training course in using one of these tools if you are not already competent with them – it will pay dividends in increased performance and in your general knowledge of the principles underlying sound reinforcement.

Testing and Maintenance

Transducers:

Your Renkus-Heinz Line Array system is a precision piece of equipment that needs periodic maintenance in order to give long and reliable service. We recommend regular testing of all cone, compression and CoEntrant drivers, preferably using a suitable test rig and process testing software or at least a sine wave generator and careful listening test coupled with a visual inspection.

Hardware:

There are several critical points in the cabinets. Of primary concern are:

- a) The machine screws attaching the enclosure to the flying hardware
- b) The screws attaching the field-replaceable horn flare to the front of the enclosure (STLA & STXLA only)
These fasteners should be regularly checked and tightened as necessary.

Cleaning:

The exterior of the cabinet and the rigging system can be cleaned with a damp cloth soaked in mild soapy water. On no account use solvent-based cleansers, which may damage the finish of the cabinet. After cleaning, the rigging system must be treated with a suitable lubricant (such as Scottoil FS365, a water-based lubricant with a mixture of machine oil, surfactant and anti-rust treatment) to prevent rusting.



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